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(54) Cleaning web

(57) A cleaning web 40 for use in electrostatic reproduction equipment including fibres the cross-section of each of which having a peripheral dimension and an area, wherein the ratio of the peripheral dimension and cross-sectional area is greater than the said ratio for a fibre of circular or substantially circular and equal area of cross-section, for instance tri-lobal or multi-lobal fibres. One side of the cleaning web may be substantially impermeable. A cleaning web having one substantially impermeable side may be produced with conventional fibres.

FIG 4

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Description

[0001] The present invention relates to a cleaning web for use in electrostatographic reproduction apparatus, printers and the like.

[0002] Conventional electrostatographic reproduction and printing apparatus, for example photocopiers, include an image section with an image roller for transferring toner onto paper to form an image, a fuser section with a heated roller for fusing the toner to adhere it to the paper and a means for cleaning the heated roller to prevent build up of toner on the roller which would otherwise impair image quality. A means for cleaning the image roller may also be provided, to remove toner which is not transferred to the paper.

[0003] In one arrangement the heated fuser section roller is cleaned by a cleaning web stored on a feed roller from which it is withdrawn and wound onto a take-up roller. The path of the web between the two rollers is such that it comes into contact with the heated roller. As the heated roller revolves surplus toner is transferred to the web which is gradually advanced from the storage roller to the take-up roller so that the web in contact with the heated roller is continually replenished to ensure that the roller is efficiently cleaned.

[0004] One existing cleaning web is composed of a heat bonded non-woven fabric formed from 70% polyethylene teraphylate (PET) and 30% aramid fibres. The fabric is impregnated with a silicone oil. In use, a film of oil is transferred on to the heated roller, this helps to prevent toner adhering to the roller. The oil also helps in the removal of any toner that does adhere to the roller and increases the capacity of the fabric to hold toner removed from the roller.

[0005] In order to reliably produce good quality images it is important that the heated fuser section roller is cleaned of all toner and other contaminants and coated with an even film of silicone oil. This is especially important in the case of colour equipment where misplaced toner in an image, as a result of toner adhering to the image roller, is more likely to be detrimental to image quality than with black and white equipment. For instance, with black and white equipment if a particle of toner adheres to the heated roller and is subsequently deposited onto a piece of paper carrying an image it will either be deposited at a white part when it will appear as an unwanted spec or a black part where it will not be noticed. In contrast, with coloured images, it is very unlikely that a particle of toner adhered to the heated roller will be deposited onto a part of an image of exactly the same colour, it is more likely to stand out.

[0006] In addition, coloured toner is usually finer than black toner, it is therefore harder to remove.

[0007] Similar considerations apply in relation to the cleaning of the image roller.

[0008] It is an object of the present invention to provide an improved cleaning web which enables the more efficient removal of toner particles and other contaminants from the fuser and image sections of electrostatographic apparatus.

[0009] According to a first aspect of the present invention there is provided a cleaning web comprising fibres the cross-section of each of which having a peripheral dimension and an area, wherein the ratio of said peripheral dimension and cross-sectional area is greater than said ratio for a fibre of circular or substantially circular and equal area of cross-section.

[0010] Such fibres exhibit an increased surface area compared to conventional fibres of circular or substantially circular cross-section, this increased surface area enhances the ability of the web to retain toner particles and to wick and store silicone oil. Overall this enhances the cleaning efficiency of the web, especially where fine and coloured toner is used.

[0011] Preferably each of said fibres are of multi-lobal cross-section, for example tri-lobal cross-section. When the web is for use in the fuser section of electrostatographic apparatus the fibres are preferably resistant to thermal breakdown at temperatures up to 260°C. Suitable fibres are formed from polyimide.

[0012] The web may also include some conventional fibres of circular or substantially circular cross-section. Indeed any proportion of shaped fibres, as described above, could be used although it is preferred that the proportion lies in the range 5 to 90% and more preferably 20 to 70%. One suitable web comprises about 20% multi-lobal polyimide fibres and about 80% conventional PET fibres. As such, it will be seen that the relatively expensive aramid fibres incorporated in conventional webs can be replaced with multi-lobal polyimide fibres. Another embodiment comprises about 20% multi-lobal polyimide fibres and about 80% conventional polyester fibres. Other suitable materials, including PTFE and PEEK, could be used in place of polyimide in the above embodiments.

[0013] The web preferably comprises a heat bonded non-woven fabric. Either flat bonded fabrics or point bonded fabrics may be employed. The web is preferably of thickness in the range 30 to 200 microns.

[0014] The principal objective of the invention is the provision of a cleaning web which provides enhanced cleaning performance. This is achieved, as described above, by the provision of a proportion of fibres with an increased surface area over conventional fibres on which to accommodate toner particles and silicone oil. It is also found that where multi-lobal fibres are used their shape contributes to improved cleaning performance as surplus toner is 'taken into' the multi-lobal shape, away from the surface of the web. The improved oil wicking capacity of multi-lobal fibres enables the web to store more silicone oil and to distribute this more evenly across the roller leading to improved cleaning and image quality. Although the invention is primarily concerned with improving cleaning performance, the increased oil and toner capacity of the web can also increase its useful life by allowing it to be advanced

more slowly during operation.

[0015] According to a second aspect of the present invention there is provided a cleaning web one side of which is intended for contacting a surface to be cleaned and the opposite side of which is substantially or completely impermeable.

[0016] According to a third aspect of the present invention there is provided a method of use of a cleaning web one side of which is substantially impermeable comprising the step of placing the opposite side of the fabric layer to that which is substantially impermeable in contact with a surface to be cleaned.

[0017] It is to be understood that the term 'side' is intended to encompass the term 'surface'.

[0018] In use the web is preferably impregnated with a silicone oil.

[0019] The web preferably comprises a non-woven fabric, heat bonded types being preferred. A suitable web is formed from a blend of PET and aramid fibres. More preferably the web is in accordance with the first aspect of the invention as hereinbefore described. Particularly, the web includes at least some fibres the cross-section of each of which having a peripheral dimension and an area wherein the ratio of said peripheral dimension and cross-sectional area is greater than said ratio for a fibre of circular or substantially circular and equal area of cross-section. Said fibres are preferably of multi-lobal cross-section for example of tri-lobal cross-section. The web preferably includes between 5 and 90%, more preferably between 20 to 70% of such fibres. Suitable fibres are multi-lobal polyimide fibres.

[0020] The non-cleaning side of the web may be rendered substantially impermeable by placing it in contact with or bonding it to a layer of substantially impermeable material.

[0021] The non-cleaning side of the web is preferably completely impermeable.

[0022] The web may be formed by placing plastic film and fabric layers together. The plastic film is preferably less than 100 microns thick, more preferably about 25 microns thick. A suitable film material is PET. The film and fabric layers may be bonded together by heat laminating.

[0023] The provision of a web with an impermeable or substantially impermeable surface allows more efficient use of the silicone oil with which the web is impregnated. In use the oil is confined between the impermeable or substantially impermeable side and the roller, or other, surface with which the web is in contact. This improves both the cleaning ability of the web and the oil distribution on the roller surface. In practice, it is found that when the cleaning web is urged towards the surface of a roller and the roller is rotated a bead of oil forms in the space adjacent the point where the web roller contacts the roller on the side from which the surface of the roller is advanced towards the web when the roller is rotated. This ensures even distribution of oil on the roller. As the roller surface passes the point of contact with the web surface the oil is wicked up by the web, leaving an even film of oil on the roller. The incorporation of multi-lobal fibres into the web leads to good wicking properties. The improved cleaning and oil distribution provided by webs having an impermeable or substantially impermeable layer leads to improved image quality, particularly in the case of colour equipment.

[0024] In order that the invention may be more clearly understood embodiments thereof will now be described by way of example and with reference to the accompanying drawings in which:-

Fig.1 shows a schematic view of the heated roller of a photocopier fuser section and cleaning web assembly including a cleaning web according to the invention;

Fig.2 shows a cross-section through some tri-lobal fibres;

Fig.3 shows an enlarged view of a portion of an alternative cleaning web according to the invention, in cross-section; and

Fig.4 shows a view of a cleaning web similar to that illustrated in Fig.3 in contact with a portion of a photocopier fuser section roller.

[0025] Referring to Fig.1 a cleaning web 11 is held in contact with the surface of a heated fuser section roller 12. In use the roller 12 rotates against the web 11 and any toner 13 on the surface of the roller is wiped onto the web 11. The web 11 is gradually advanced from a feed roller 14 to a take up roller 15 so that the web 11 in contact with the surface of the roller 12 is continually replaced.

[0026] The web 11 is formed by a flat heat bonded non-woven fabric composed of about 20% tri-lobal polyimide fibres and 80% PET fibres. The web is impregnated with a silicone oil. The web is about 100 microns thick.

[0027] Fig.2 shows a number of typical cross-sections of the polyimide fibres included in the web illustrated in Fig.1. The fibres are of tri-lobal cross-section, the ratio of the peripheral distance around each cross-section to its area is greater than that for fibres of circular or substantially circular cross-section having the same cross-sectional area. The total surface area of a tri-lobal fibre is therefore greater than that for conventional fibres of circular or substantially circular and similar area of cross-section.

[0028] The provision of tri-lobal fibres in the web 11 increases the capacity of the web to hold toner particles and to wick up and retain silicone oil. This is due to both the increased surface area of the fibres compared to conventional fibres and their tri-lobal shape. It is found that toner particles are received into the shape,

between the lobes. This enables the web material to more effectively and thoroughly clean and distribute silicone oil over the surface of the roller 12. This enables improved image quality and heated roller life to be obtained.

[0029] Referring to Fig.3, an alternative web 30 comprises a heat bonded non-woven fabric layer and an impermeable 100 micron thick layer of a flat heat bonded non-woven fabric composed of about 20% trilobal polyimide fibres and 80% PET fibres 31 impregnated with a silicone oil bonded to a 25 microns thick impermeable PET film 32. A suitable film is that supplied by ICI under the trade mark Mylar.

[0030] Fig.4 shows a web 40, similar to that shown in Fig.3, used to clean the heated fuser section roller 41 of a photocopier. The web 40 is urged towards the surface of the roller 41, this tends to compress the fabric layer against the roller and displace silicone oil 42 from the fabric. The presence of an impermeable film layer on the opposite side of the fabric layer to that which is adjacent the surface of the roller 41 prevents oil escaping from the surface. Compared with conventional webs, therefore, an increased amount of oil is presented to the roller 41. In practice a bead of silicone oil 42 forms on the surface of the roller which is advanced towards the fabric. This ensures even distribution of oil on the surface of the roller. Where the web 40 separates from the roller this bead of oil 42 is wicked back into the fabric. The improved oil distribution achieved by backing the fabric with an impermeable film leads to both improved image quality, particularly in the case of colour equipment, and increased fuser section life.

[0031] The above embodiments are described by way of example only, many variations are possible without departing from the invention. For example, the cleaning webs described could be employed in the image section of electrostatographic apparatus.

Claims

1. A cleaning web comprising fibres the cross-section of each of which having a peripheral dimension and an area, characterised in that the ratio of said peripheral dimension and cross-sectional area is greater than said ratio for a fibre of circular or substantially circular and equal area of cross-section.

2. A web as claimed in claim 1, wherein the said fibres are of multi-lobal cross-section.

3. A web as claimed in either claim 1 or 2, wherein the said fibres are resistant to thermal breakdown at temperatures up to 260°C.

4. A web as claimed in any preceding claim, wherein the said fibres are formed from polyimide.

5. A web as claimed in any preceding claim also including some conventional fibres of circular or substantially circular cross-section.

6. A web as claimed in claim 5, wherein the proportion of fibres of the type specified in claim 1 lies in the range 5 to 90%.

7. A web as claimed in claim 5, wherein the proportion of fibres of the type specified in claim 1 lies in the range 20 to 70%.

8. A web as claimed in claim 1 comprising about 20% multi-lobal polyimide and/or PTFE and/or PEEK fibres and about 80% conventional PET and/or polyester fibres.

9. A web as claimed in any preceding claim comprising a heat bonded non-woven fabric.

10. A web as claimed in claim 9, wherein the fabric is of the flat or point bonded type.

11. A web as claimed in any preceding claim of thickness in the range 30 to 200 microns.

12. A cleaning web as claimed in any preceding claim, wherein one side of which is intended for contacting a surface to be cleaned and the opposite side is substantially or completely impermeable.

13. A cleaning web as claimed in either claim 11 or 12, wherein the said opposite side is rendered impermeable by placing it in contact with or bonding it to a layer of substantially or completely impermeable material.

14. A web as claimed in claim 13 comprising fabric and plastic film layers.

15. A web as claimed in claim 14, wherein the plastic film is less than 100 microns thick.

16. A web as claimed in claim 14, wherein the plastic film is about 25 microns thick.

17. A web as claimed in any of claims 14 to 16, wherein the plastic film comprises PET.

18. A web as claimed in any of claims 14 to 17, wherein the fabric and film layers are bonded together by heat laminating.

19. A cleaning web one side of which is intended for contacting a surface to be cleaned and the opposite side of which is substantially or completely impermeable.

20. A web as claimed in claim 19, wherein the said

opposite side is rendered impermeable by placing it in contact with or bonding it to a layer of substantially or completely impermeable material.

21. A web as claimed in claim 20, comprising fabric and plastic film layers.

22. A web as claimed in claim 21, wherein the plastic film is less than 100 microns thick.

23. A web as claimed in claim 21, wherein the plastic film is about 25 microns thick.

24. A web as claimed in any of claims 19 to 23, wherein the plastic film comprises PET.

25. A web as claimed in any of claims 19 to 24, wherein the fabric and film layers are bonded together by heat laminating.

26. A method of use of a cleaning web as claimed in any of claims 12 to 25 comprising the step of placing the side of the cleaning web intended for contacting a surface to be cleaned in contact with a surface to be cleaned.

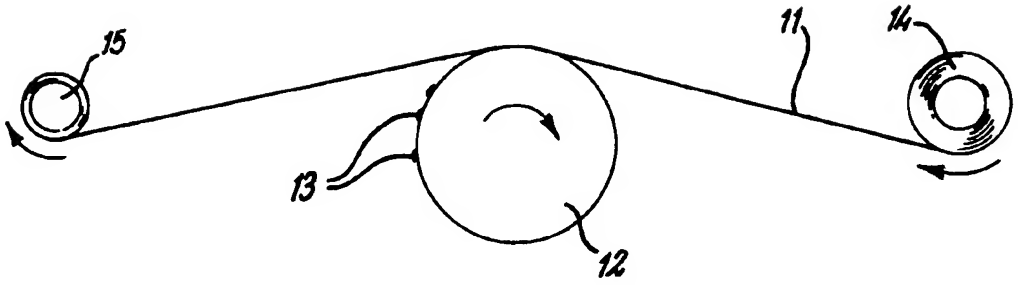

FIG.1

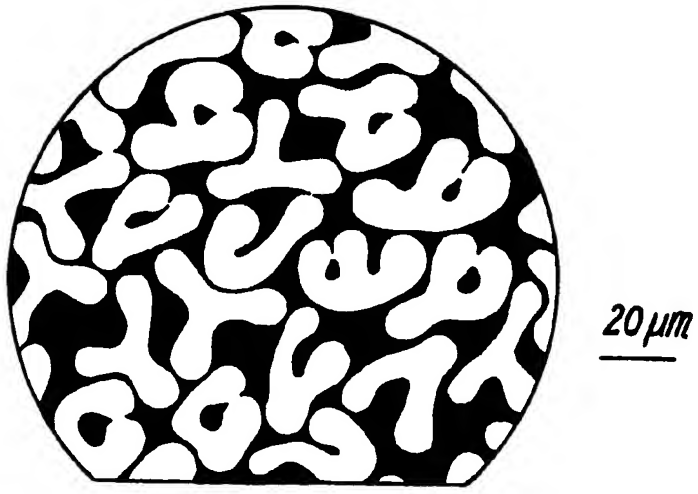

FIG.2

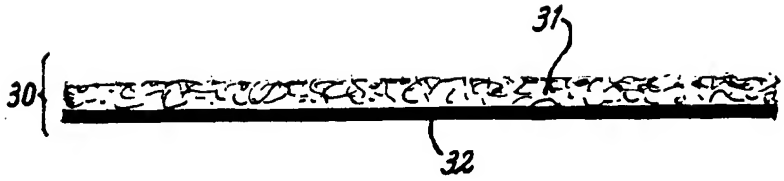

FIG.3

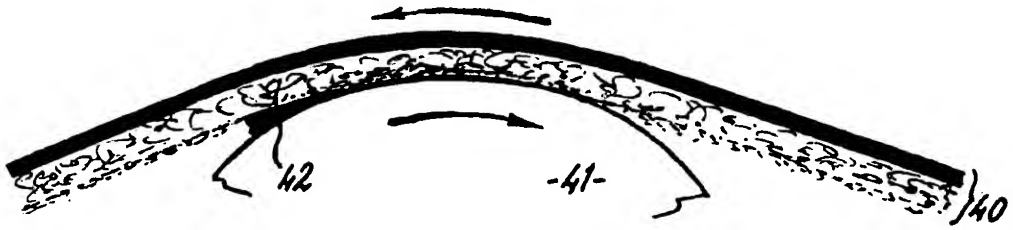

FIG.4